Capability Maturity Model Integration (CMMI®) From a Project Management Perspective

Jesse Martak, President

Martak Consulting Services, Inc.

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Presentation Topics

- Background on CMM® and CMMI®

- Features of the CMMI® model

- CMMI® emphasis on project management

- CMM® and CMMI® Implementation
  Lessons Learned

The Software Engineering Institute (SEI)

- ➢ Federally Funded Research & Development Center (FFRDC) at Carnegie Mellon University

- ➢ Mission is to foster improvement of project and software processes

- ➢ Developed Capability Maturity Model® (CMM®) and Assessment Methodology (CBA IPI)

- ➢ Developed Capability Maturity Model Integration (CMMI®) and Appraisal Methodology (SCAMPI^{SM})

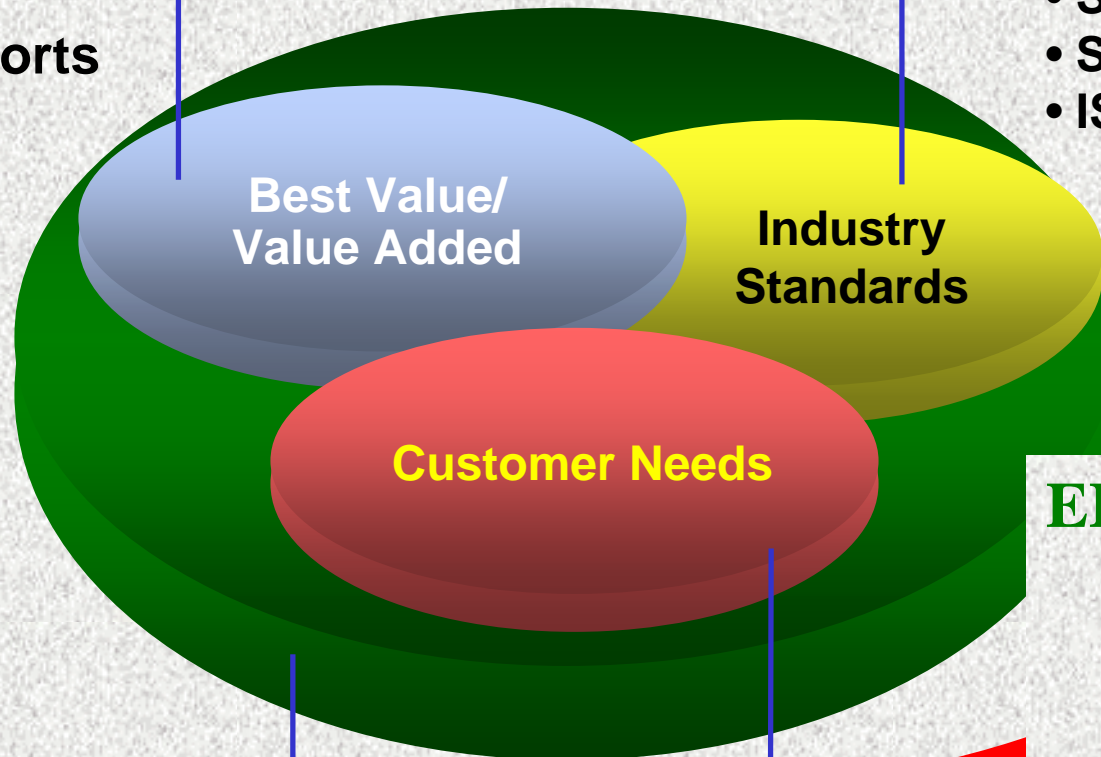- ➢ SEI authorizes lead appraisers to facilitate CBA IPI and SCAMPI^{SM} appraisals

The Evolution of CMMI from Other Models

Best Value/Best Practice
- **Organization**
- **Industry Reports**
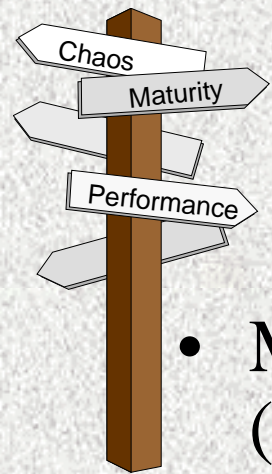
Industry Standards
- **SEI CMM**
- **SE CM & EIA 731**
- **ISO**

Best Value/Value Added

Industry Standards

Customer Needs

EIA/IS 731 Key to Rapid CMMI Transition

Capability Model Integration
- **CMMI**

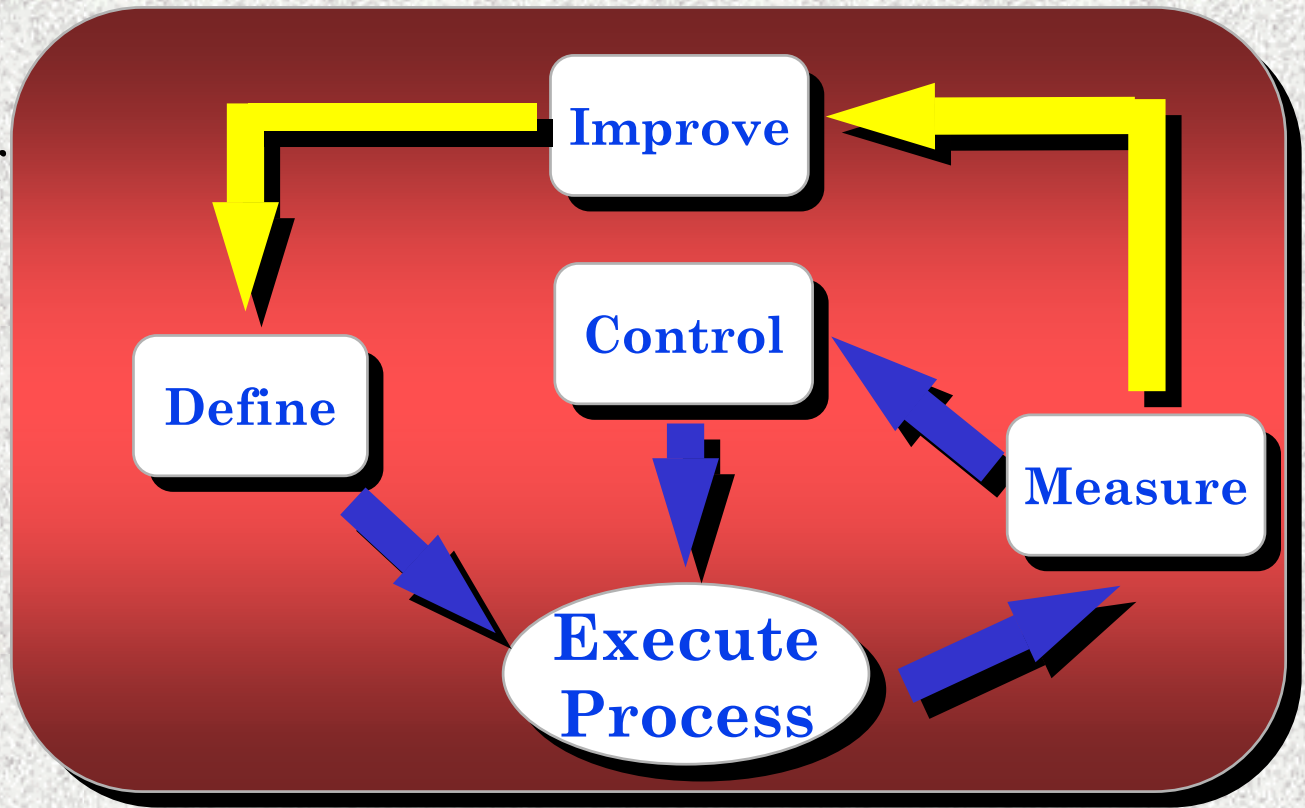**Prime Contractor Specs**

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What are the CMM® and CMMI®?

- Models for organizational Process Improvement (PI) and improved practices
  - They benchmark the process not the product
- Community-owned PI framework to support an organization's process improvement project
  - Facilitates identifying, importing, and adopting best practices
  - Framework includes reference models, training products and appraisal methods
- An underlying structure for reliable and consistent project and organization process appraisals

Process Management Premise

- An undefined process cannot be controlled (or measured)

- An uncontrolled process cannot be improved

- Attempting to improve an unstable process yields further instability

Improve

Control

Define

Measure

Execute Process

Adapted from SEI

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CMMI® Models and Representations

- CMMI® Models
  - CMMI® - SW (Software only)
  - CMMI® - SE/SW (Systems & Software)
  - CMMI® - SE/SW/IPPD (+Integrated Product & Process Development)
  - CMMI® - SE/SW/IPPD/SS (+Supplier Sourcing)

- CMMI® Representations
  - Staged Representation
  - Continuous Representation

The Evolution of Process Areas from CMM® to CMMI ®

Level	CMM Key Process Areas (KPA's)	CMMI Process Areas (PAs)
5 Optimizing	Process Change Management Technology Change Management Defect Prevention ……………………………..	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	Software Quality Management Quantitative Process Management	Organizational Process Performance Quantitative Project Management
3 Defined	Software Product Engineering Peer Reviews ………………………………. Organizational Process Focus …………... Organizational Process Definition ………. Training Program …………………………. Intergroup Coordination Integrated software Management ………...	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management for IPPD Risk Management Integrated Teaming Integrated Supplier Management Decision Analysis and Resolution Organizational Environment for Integration
2 Managed	Requirements Management Software Project Planning Software Project Tracking & Oversight Software Sub-contract Management Software Quality Assurance Software Configuration Management	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Initial		

The Continuous Representation Has Six Capability Levels
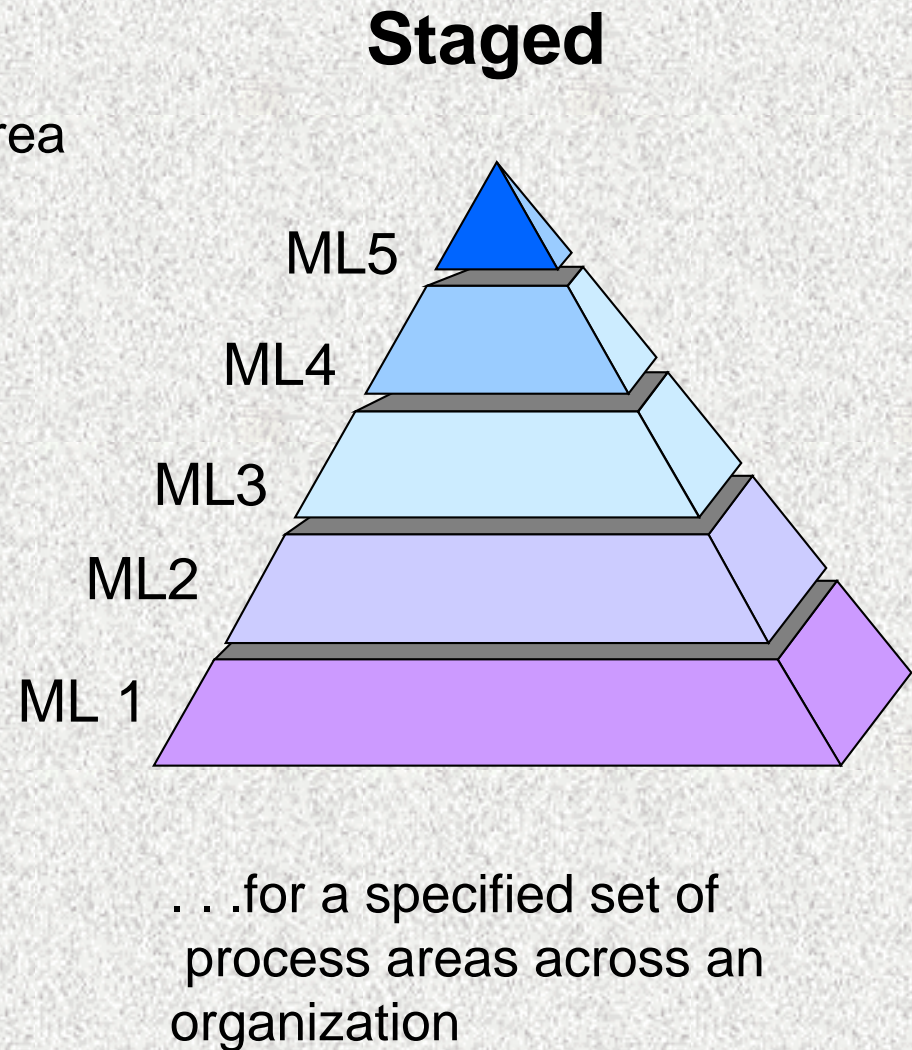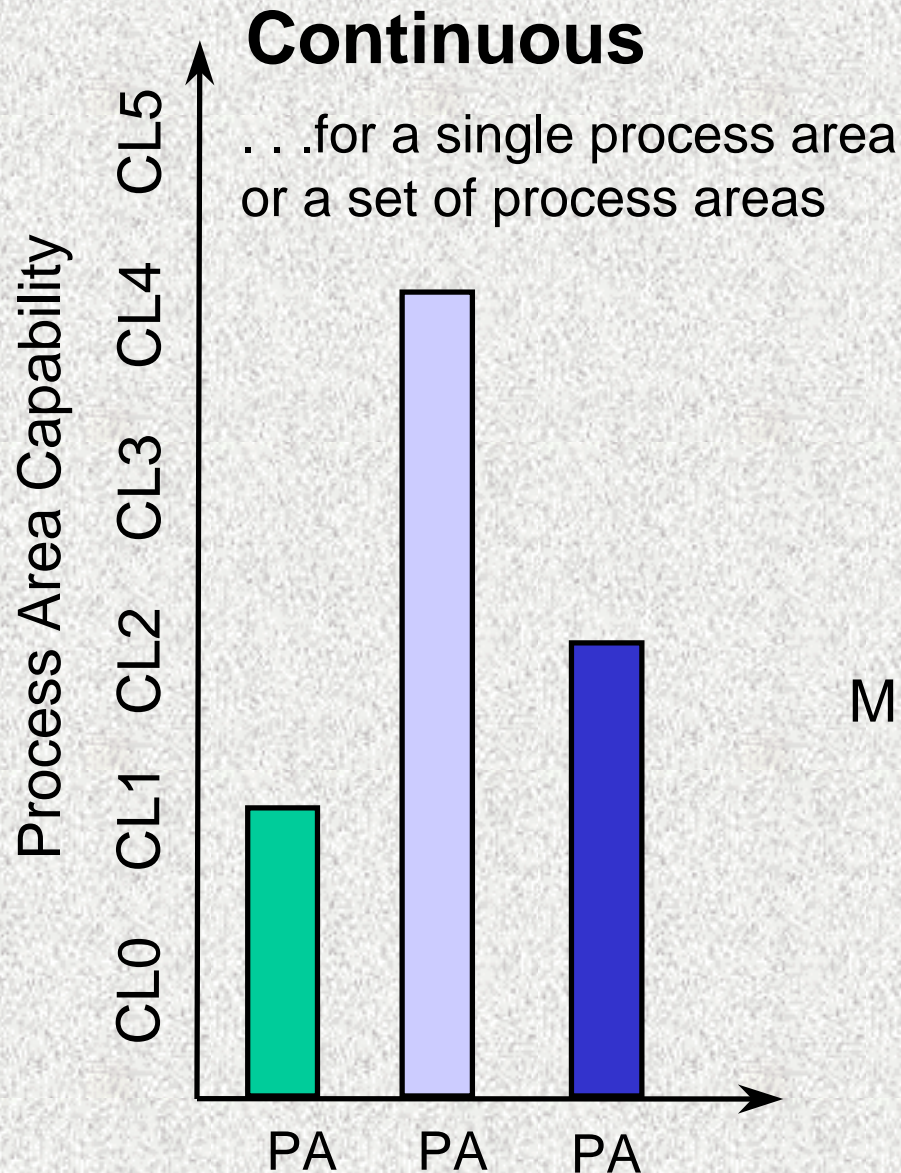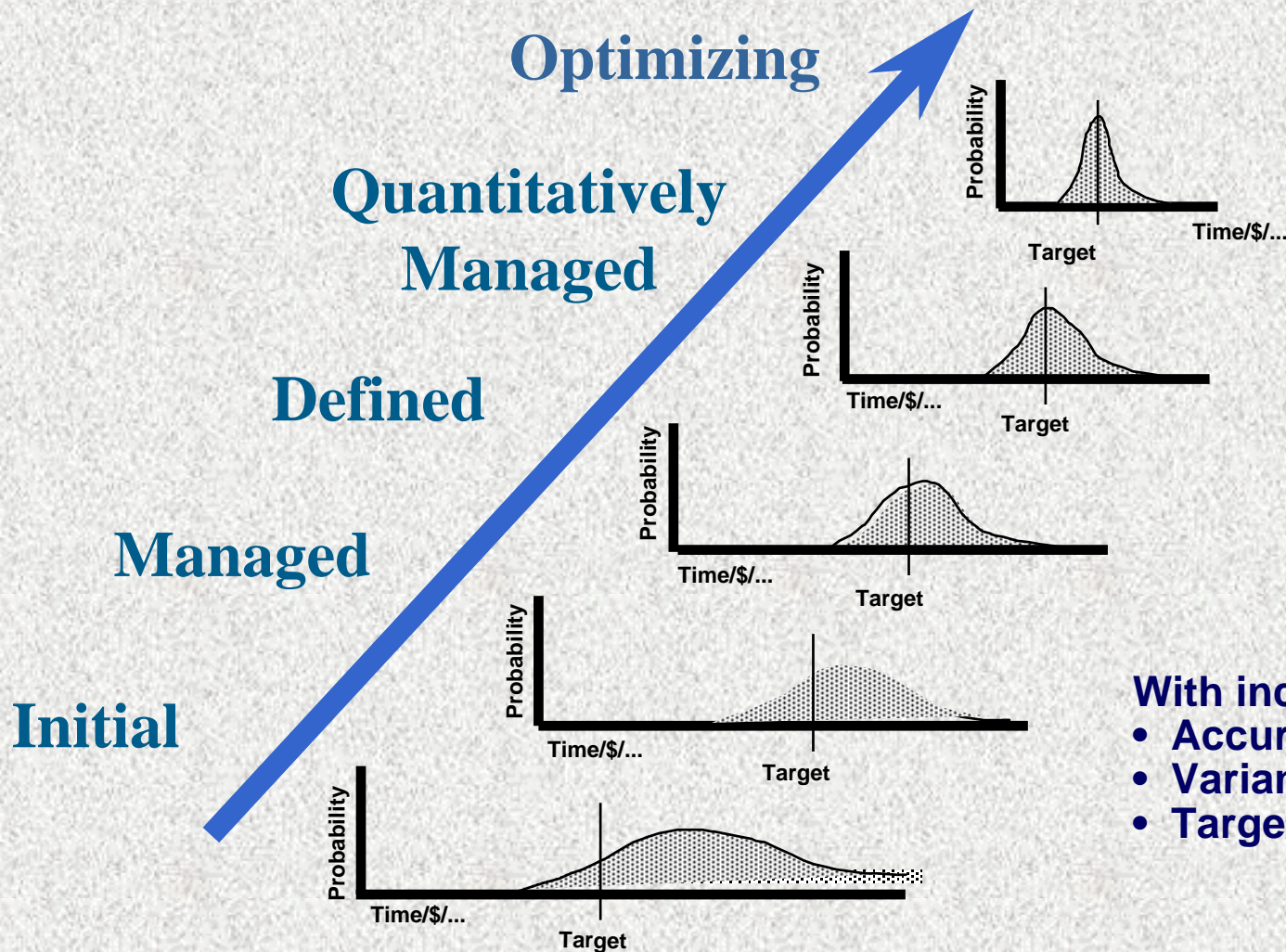
5 Optimizing

4 Quantitatively Managed

3 Defined

2 Managed

1 Performed

0 Incomplete

A Comparison of the Staged and the Continuous

Continuous

. . .for a single process area
or a set of process areas

Process Area Capability

CL0 CL1 CL2 CL3 CL4 CL5

PA   PA   PA

Staged

ML5

ML4

ML3

ML2

ML 1

. . .for a specified set of
 process areas across an
organization

Reduced Risk; Improved Productivity and Quality

Optimizing

Quantitatively Managed

Defined

Managed

Initial

With increasing maturity
- **Accuracy increases**
- **Variance reduces**
- **Target improves**

(Each stage shows a probability distribution graph with axes labeled "Probability" and "Time/$/..." and a vertical "Target" line; with increasing maturity the distributions become narrower and more peaked.)

How CMMI® Supports Planning and Managing a Project

- Project Management process areas
- Engineering process areas
- Support process areas
- Process Management process areas

Primary Focus of Project Management Process Areas

Project Planning	•Establish and maintain estimates •Develop a project plan •Obtain commitments to the plan
Project Monitoring & Control	•Monitor project against the plan •Manage corrective actions to closure
Risk Management	•Prepare for risk management •Identify and analyze risks •Mitigate risks
Supplier Agreement Management	•Establish supplier agreements •Satisfy supplier agreements

Primary Focus of Engineering Process Areas

Requirements Management	•**Manage requirements and reconcile inconsistencies**
Requirements Development	•**Develop customer requirements** •**Develop product requirements** •**Analyze and validate requirements**
Technical Solution	•**Select product-component solutions** •**Develop the design** •**Implement the design**
Product Integration	•**Prepare for product integration** •**Ensure interface compatibility** •**Assemble product components & deliver product**
Verification & Validation	**Prepare for & perform Verification & Validation** **Perform peer reviews**

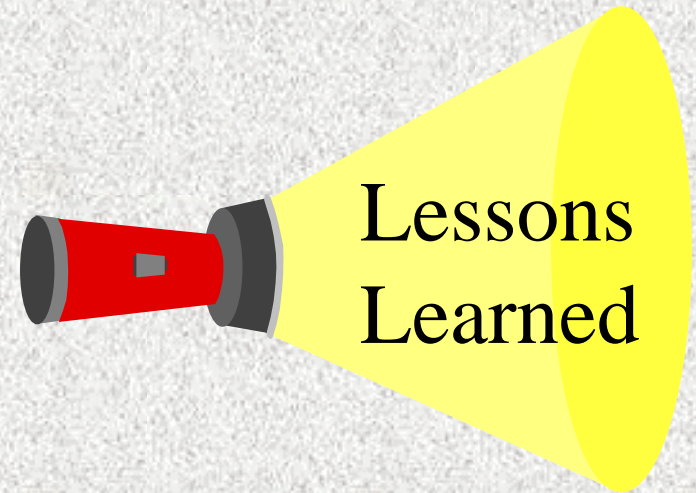# Primary Focus of Support Process Areas

Configuration Management	•**Establish product baselines** •**Track and control changes** •**Establish baseline integrity**
Quality Assurance	•**Objectively evaluate processes and products** •**Provide objective insight to engineering & management**
Measurement & Analysis	•**Business focus for measurement & analysis activities** •**Provide measurement results**
Decision Analysis & Resolution	•**Evaluate alternatives using established criteria**

Primary Focus of Process Management Process Areas
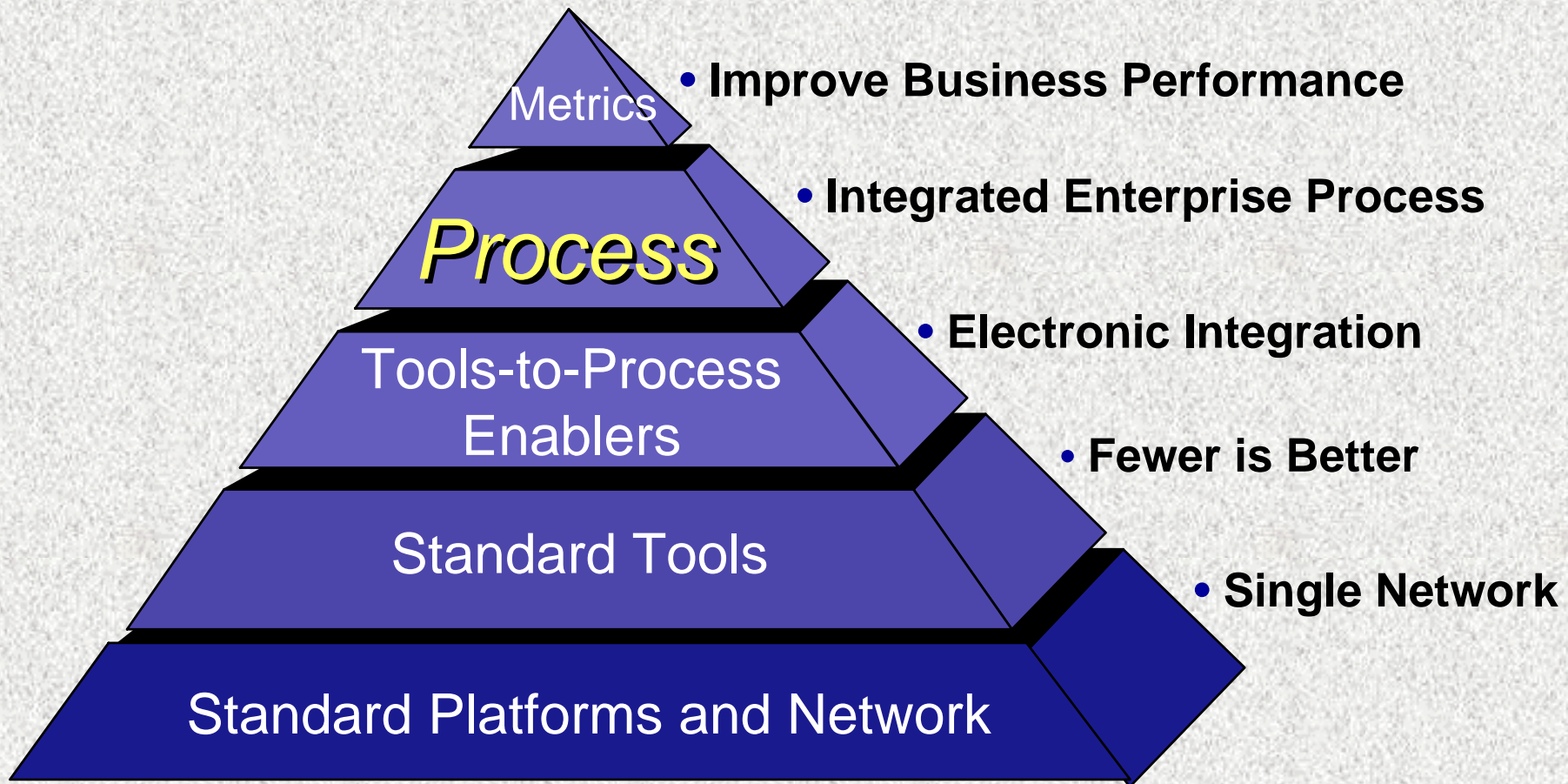
Organizational Process Focus	•Determine process improvement opportunities •Plan and implement process improvement opportunities
Organizational Process Definition	•Establish organizational process assets
Organizational Training	•Establish an organizational training capability •Provide the necessary training
Integrated Project Management	•Use organizational assets to establish project's process •Manage the project using integrated plans •Coordinate and collaborate with relevant stakeholders

Lessons Learned When Implementing CMM® and CMMI®

- Establish infrastructure early
- Manage process improvement like a project
- Include project personnel
- Pilot on select projects prior to deployment
- Process training essential to success
- Consider an integrated program plan across all disciplines

Lessons Learned

Infrastructure Creates Efficiency and Improvement

Pyramid levels (top to bottom):
- Metrics
- Process
- Tools-to-Process Enablers
- Standard Tools
- Standard Platforms and Network

Annotations:
- • Improve Business Performance
- • Integrated Enterprise Process
- • Electronic Integration
- • Fewer is Better
- • Single Network

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Basics of Getting Started

- Select the appropriate process group staff to achieve goals
  - Project experience
  - QA & CM reps
  - Core group full time
  - Working groups channel part-time resources
  - Outside resources
- Establish the (S)EPG, PAL, Training DB & Measurement System as soon as possible – Level 2 as foundation for higher levels

Consistency

Ownership Process Culture

Credibility
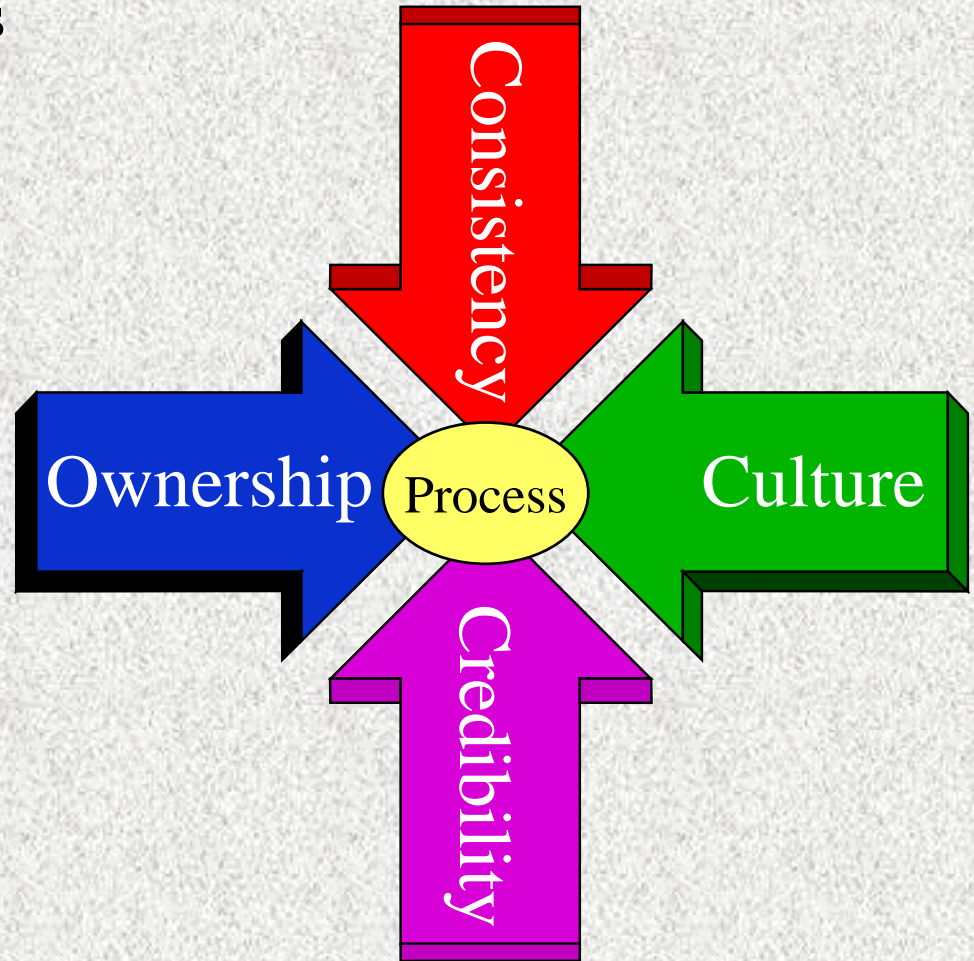
Successful Planning *Includes* Designers

- (S)EPG/PCCB: Process Group
- PICT: Process Improvement Core Team (Users' Group)
- TWG: Technology Working Groups
- *Systems, Hardware and Software Engineers*

Standard Process

(S)EPG   **PICT**   **TWGs**   **Designers**
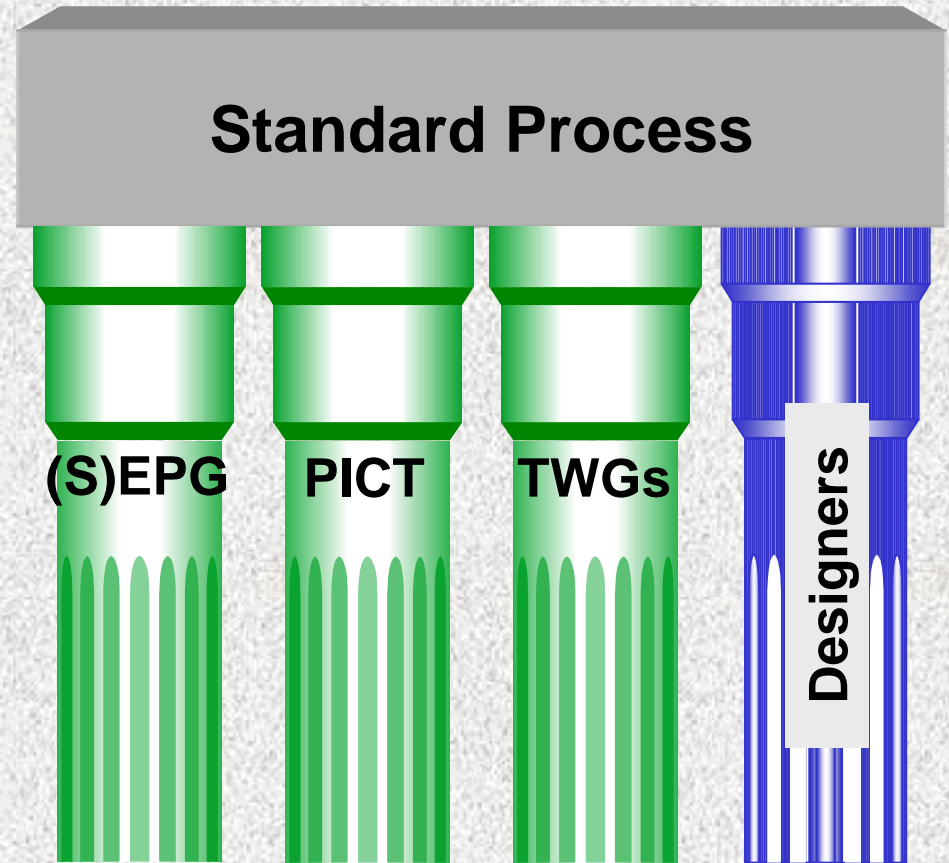
Process Improvement is a "Project" of Itself – Not an Organizational Task

- Requirements must be well defined
- Build a little; test a little for proof of concept & methods
- Use experts to kick start the process

- Long Range Strategic Plan - vision
- Monthly Senior Mgmt reviews
- "Peer Reviews" for "buy-in"
- Staffing Needs and Capabilities Evolve over Time

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Define → Plan → Train → Do → (back to Define)
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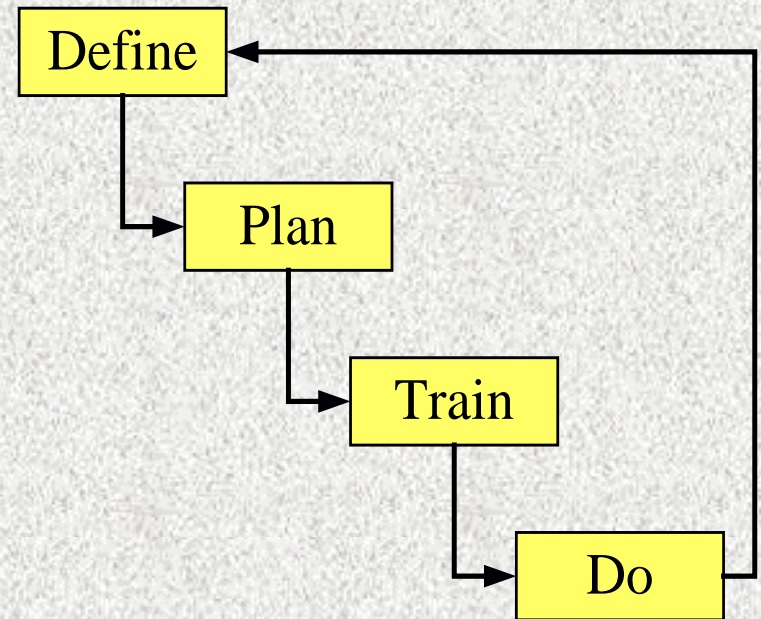
Piloting Gets The Kinks Out Early Reducing User Dissatisfaction

- Small set of 1 to 3 projects
  - Mature
  - Open minded
- Midcourse Corrections
- Effective (S)EPG Support
- Formal Reviews
- Alternate Funding Sources
- Advantages
  - Verify process & data
  - Obtain buy-in of projects

**Before rolling out process to the total organization ...**

Proven Tools

Tested Methods

Satisfied Users

Defined ROI

Clear Procs
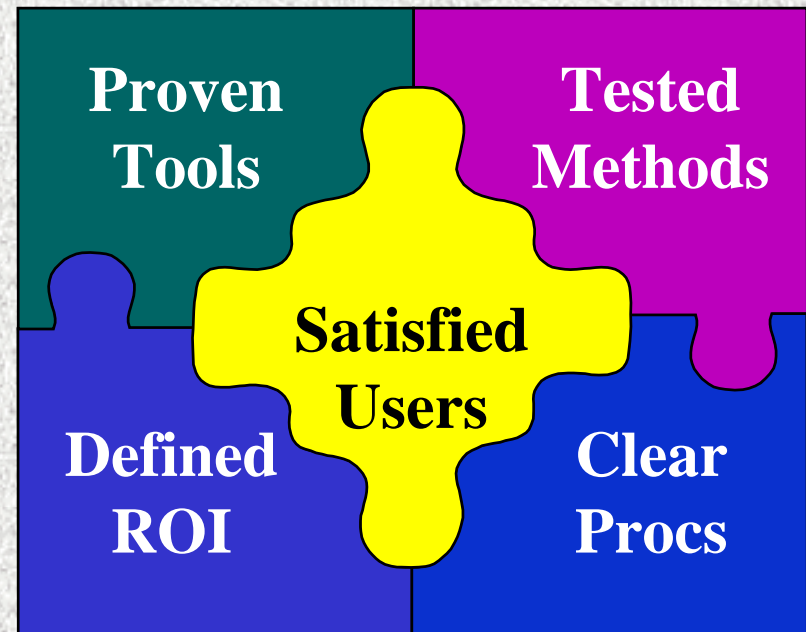
... mature the process and tools to neutralize the "nay-sayers"

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Educating the Work Force

- Use classroom, mentoring and just-in-time training
- Advantages of just-in-time training
    - Mentor/trainer assigned to projects
    - Real project artifacts as homework problems
    - Mentor/trainer helps project tailor process
    - More time efficient for project leaders
- Select right personnel for mentors/trainers

Transition to CMMI Introduced
Process Integration Requirements
as well as Unique Cultural Issues
with Systems and Hardware Engineering
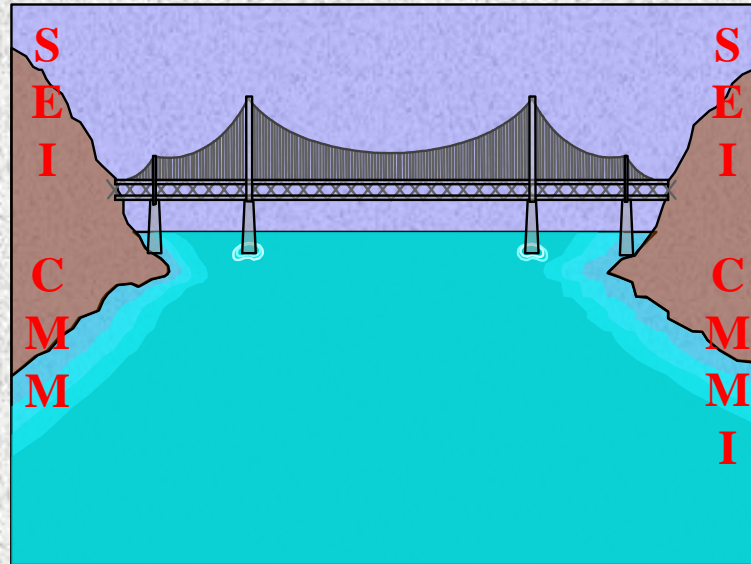
Integrated Program Plan Is Key Element

- Total Program Plan
  - Program Overview
  - Program Organization
  - Integrated Schedules
  - Integrated Metrics

- Comprehensive Plans
  - Processes
  - Work Products
  - Key Milestones
 - Acceptance Criteria
  - Responsibility
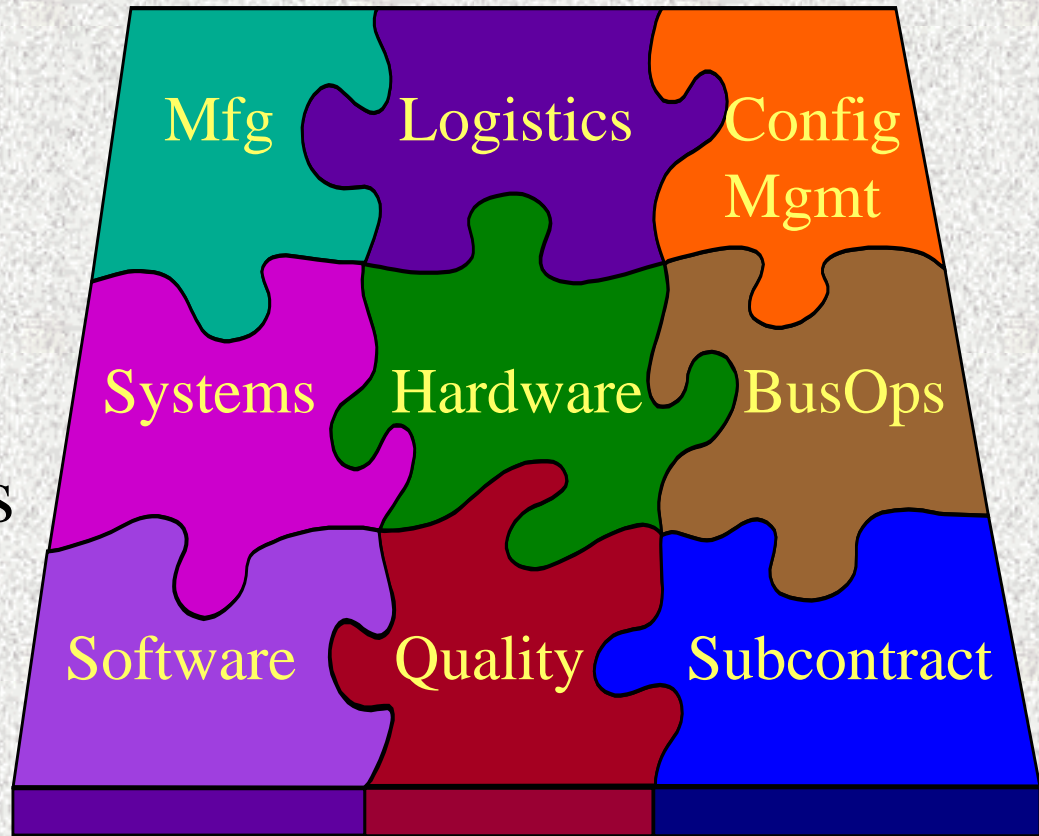
Cooperative Effort Yields Success

- Evaluate and adopt software processes that demonstrate value added, such as peer reviews

- Expand software quality role to include "total" process evaluations to program plans

- Eliminate "stovepipe" plans (unless contractual)

- Select program managers & pilots with innovative nature

Higher Levels Focus on Optimizing ROI

- Projects must take charge & drive process
- Data consistency becomes critical
- User participation increases at higher levels (Lots of data - engineer's dream "FUN")
- Results must clearly show return on investment (ROI)
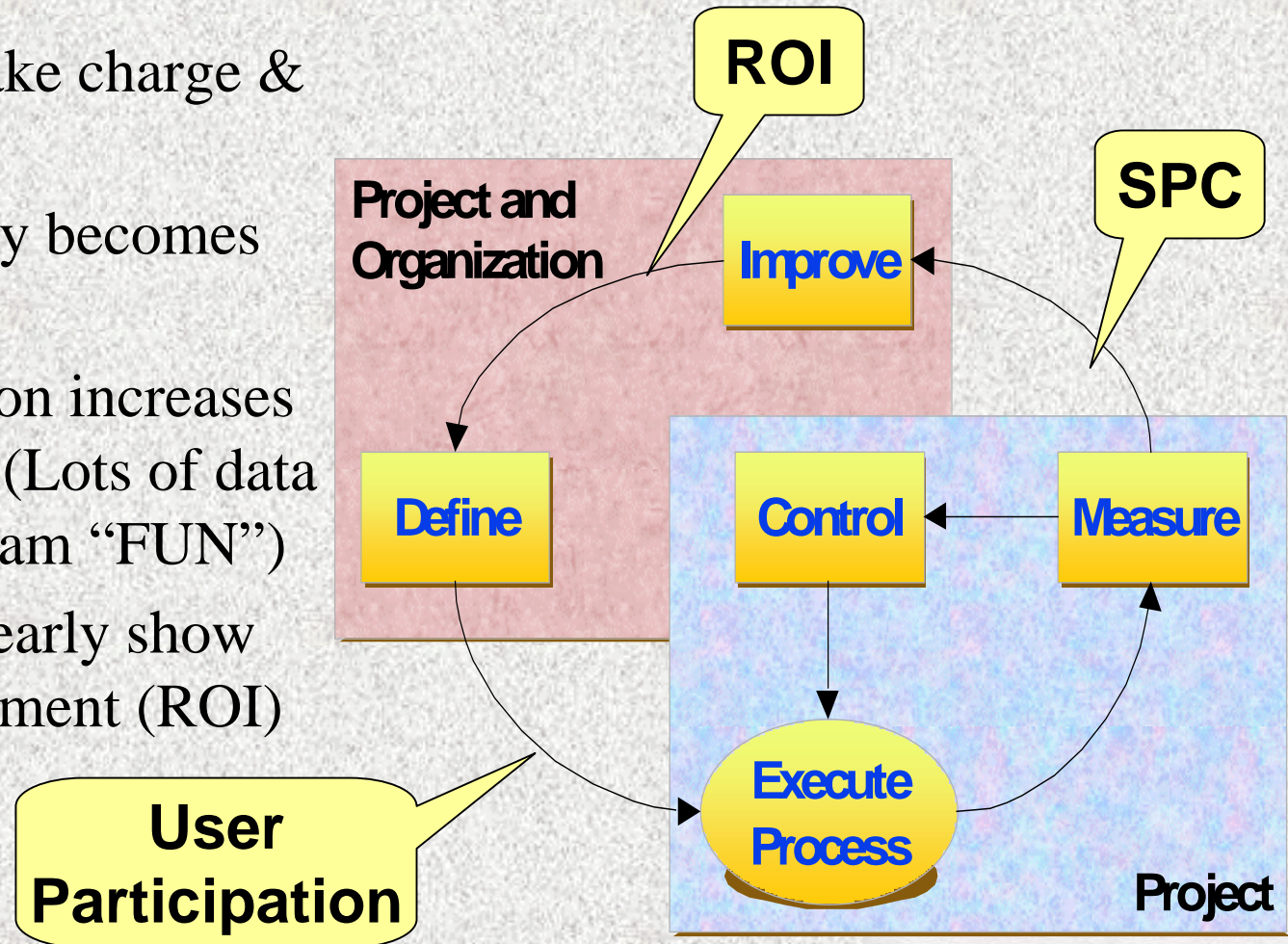
Keys to Success – CMM or CMMI

- Get support of *senior management*

- Install *strong managers* in pilot programs

- Include *process lead* in project's budget

- Provide *mentors* to programs

- Start small - select a few key *pilot projects*

- Maintain involvement of designers as *team members*

- Provide an easy to use *system interface*

- Use *statistics* to provide feedback and improve products

Acknowledgements

- **® CMM, CMMI and Capability Maturity Model are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University**

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Q&A

Contact Information

Jesse Martak, President
Martak Consulting Services, Inc.
3959 White Rose Way
Ellicott City, MD – 21042
Jmartak@aol.com
410-465-3923 (office)
410-804-8954 (cell)